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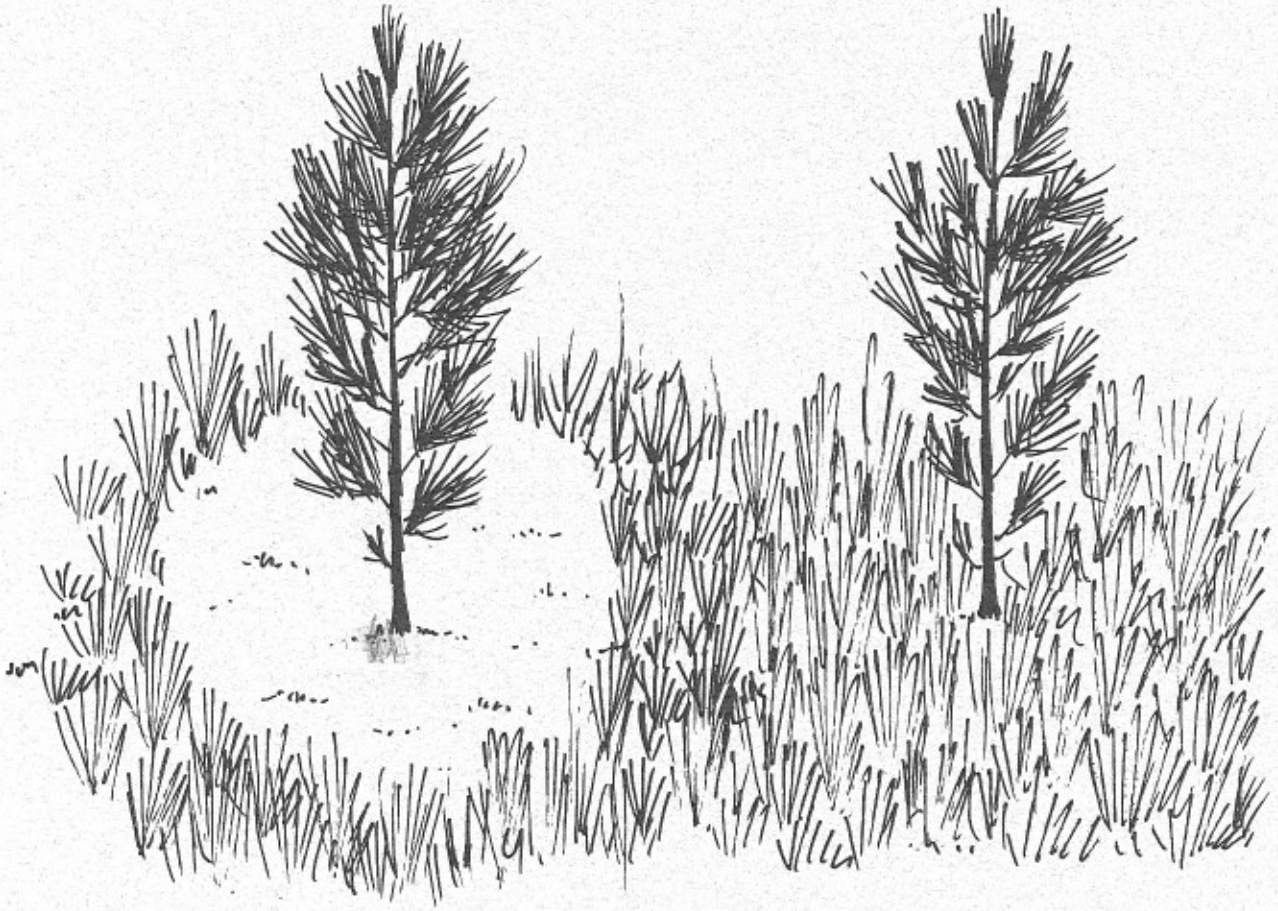
Controlling Herbaceous Competition and Tip Moth - Effects after Sixteen Years



by Thomas A. Dierauf and John A. Scrivani

VIRGINIA DEPARTMENT OF FORESTRY

Controlling Herbaceous Competition and Tip Moth - Effects after Sixteen Years

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Abstract

Four treatments: herbaceous vegetation control, tip moth control, both herbaceous vegetation and tip moth control, and a control; were applied to 49 tree plots of loblolly pine seedlings in three randomized blocks.

At age 16, control of herbaceous vegetation had increased average height by about two feet, average DBH by about a half an inch, average basal area per acre by about 25 square feet, and average yields by about seven standard cords per acre. Tip moth control had only a slight effect on height, DBH, basal area, and yields.

Procedure

The study was a comparison of four treatments:

1) untreated
2) treating to control herbaceous vegetation
3) treating to control tip moth (Nantucket Pine Tip Moth)
4) treating to control both herbaceous vegetation and tip moth

These four treatments were replicated three times in randomized blocks on the Appomattox-Buckingham State Forest (Figure 1). Individual plots contained 49 loblolly pine seedlings, seven rows of seven seedlings, at a spacing of eight by eight feet. These were planted in the spring of 1978. Tip moths were controlled with Thimet 10G in mid-March of both 1978 and 1979. Herbaceous vegetation was controlled using Aatrex 4L applied at a rate of four pounds active ingredient per acre. Aatrex was applied three times: in April of 1978, 1979, and 1981 to a three foot radius spot around each seedling. Hardwood sprouts were controlled by basal spraying in the spring of 1978 and in June and October of 1981, using a mixture of 3% Garlon 4 in diesel oil. In May of 1982, volunteer pine seedlings were cut down and also some hardwood sprouts that had survived the basal spraying. These treatments to control hardwood sprouts were applied to all four treatments, including the check plots.

The control of herbaceous vegetation had a striking effect on early growth of the

loblolly seedlings; not only were they taller, but they had much larger crowns with heavier and darker needles. As the pines got larger and started to shade out the herbaceous vegetation, the differences became less noticeable, and eventually, there was no difference in the appearance of the pines.

South ↗

Check	**Weed & Insect**	**Insect**	**Weed**	**Check**	**Weed & Insect**
Insect	**Weed**	**Weed & Insect**	**Check**	**Weed**	**Insect**

Figure 1. Layout of study.

Results

The central 25 trees of each 49 tree plot were measured at age three, four, five, six, twelve, fourteen, and sixteen years. Total height to the nearest foot was measured each time, and diameter at breast height was measured to the nearest inch at ages twelve, fourteen, and sixteen.

Analysis of variance and Duncan's new multiple range test were used to evaluate treatment effects.

Survival

Survival at age three ranged from 80 to 100 percent on the 25 tree plots. Average survival at each measurement is shown in Table 1. At age 16, survival differences among treatments were not statistically significant (probability of a larger F = .829 after transforming survival percents to arc sine percent).

Table 1. Average survival at each measurement for the central 25 trees of each plot.

	Percent Survival at Age						
Treatment	**3**	**4**	**5**	**6**	**12**	**14**	**16**
Check	89	89	89	89	89	88	88
Weed	92	92	91	91	91	91	88
Tip Moth	92	92	92	92	92	92	92
Weed & Tip Moth	97	97	97	97	97	97	93

Height Growth

Control of herbaceous vegetation increased height growth considerably for the first few years, and tip moth control also improved height growth slightly (Table 2). At age three, plots receiving both herbaceous vegetation and tip moth control were 33% taller than check plots. By age six, height growth differences had about leveled off (Figure 2), and by age sixteen plots receiving both herbaceous vegetation and tip moth control were only 5% taller than check plots. At age 16, height differences among treatments were not statistically significant (probability of a larger F = .500).

Table 2. Average height in feet at each measurement.

	Height at Age							
Treatment	**3**	**4**	**5**	**6**	**12**	**14**	**16**	**Age 16 Adjusted**
Check	5.9	9.5	13.5	16.4	34.9	41.5	47.1	46.5
Weed	7.6	11.4	15.5	18.5	36.1	41.9	48.6	49.1
Tip Moth	6.4	10.2	14.4	17.4	35.4	40.9	46.5	47.0
Weed & Tip Moth	7.9	11.7	16.1	19.1	37.7	43.5	49.4	48.8

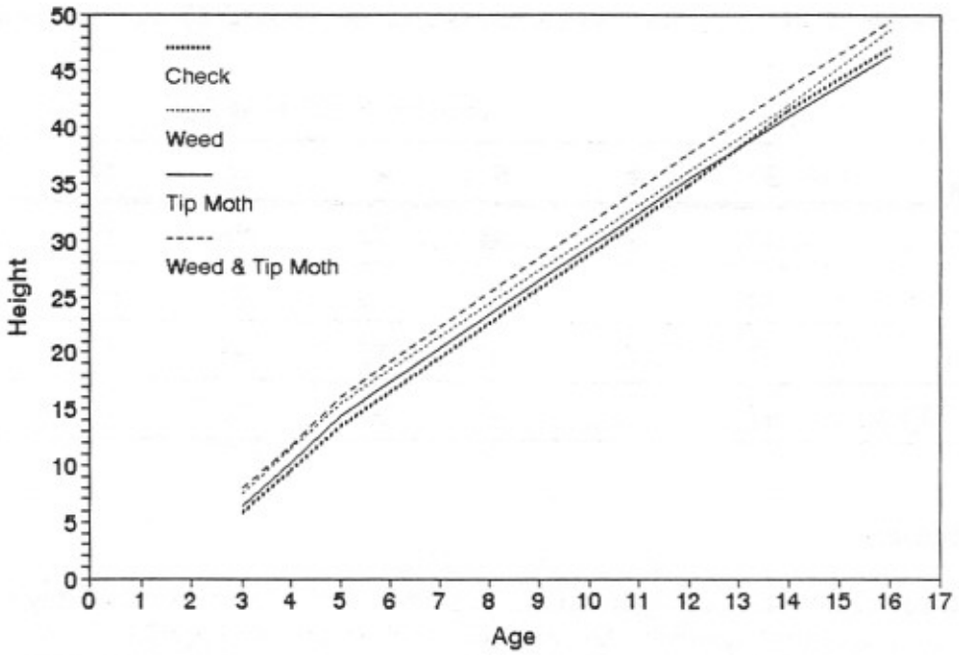

Figure 2. Average height by treatment and age.

An unexpected difference in site index has shown up. The trees in the upper two plots of each replication have not grown as fast as the trees in the lower two plots of each replication. The study area extends lengthwise along a broad ridge, and the three replications slope gently to the southeast. The lower plots are on the convex part of the slope and the upper plots are close to the ridge line. Usually, site index does not increase until the concave, lower slope, because greater soil erosion on the convex part of the slope usually offsets the advantage of being further down slope.

Average heights for each plot were adjusted for slope position. The six lower plots averaged 49.6 feet at age 16 and the six upper plots averaged 46.2 feet, a difference of 3.4 feet. Average heights were adjusted by adding 1.7 feet (half of 3.4 feet) to the height for each upper plot and subtracting 1.7 feet from the height for each lower plot (Table 2). This adjustment does not change the overall mean height, and provides a more valid comparison of treatment effects at age 16. Overall average heights were reduced slightly for the check and weed plus tip moth treatments, which had two plots downslope, and increased slightly for the weed and tip moth treatments, which had only one plot downslope (Figure 1).

Diameter Growth

Control of herbaceous vegetation increased diameter growth considerably (Table 3). By age 16, weed control had increased average DBH by .46 inch and tip moth control had no effect. At age 16, differences in average DBH were statistically significant (probability of a larger F = .018). In Table 3 for age 16, means followed by the same letter are not significantly different at the .05 level.

Adjusting each plot mean for slope position, as described above, made very little difference (Table 3).

Table 3. Average diameter at breast height at age 12, 14, and 16.

Treatment	Average DBH at Age			
	12	14	16	Age 16 Adjusted
Check	5.76	6.26	6.68 a	6.66
Weed	6.14	6.70	7.14 b	7.16
Tip Moth	5.79	6.37	6.66 a	6.68
Weed & Tip Moth	6.19	6.67	7.14 b	7.12

Basal Area Growth

Control of herbaceous vegetation also improved basal area growth (Table 4), and at age 16, differences in average basal area were statistically significant (probability of a larger F = .034). In Table 4 for age 16, means followed by the same letter are not significantly different at the .05 level.

Plot means at age 16 were adjusted for slope position as described above (Table 4). The increase in basal area related to tip moth control is probably explained by the slightly better survival for plots receiving tip moth control (Table 1).

Table 4. Average basal area per acre at age 12, 14, and 16.

Treatment	Average Basal Area at Age			
	12	14	16	Age 16 Adjusted
Check	111.8	131.4	150.7 a	149.2
Weed	132.1	157.5	171.5 b	173.1
Tip Moth	118.6	143.3	156.7 a	158.2
Weed & Tip Moth	142.3	165.1	180.5 b	178.9

Volume Growth

Average yields in standard cords at age 16 were considerably greater for plots receiving herbaceous vegetation control (Table 5). As for basal area, the slightly better yields for plots receiving tip moth control is probably explained by slightly better survival. Differences among treatments were not statistically significant (probability of a larger F = .139), and using Duncan's range test, none of the differences between individual treatments were significant.

Adjustment of plot means for slope position changed overall treatment means by .9 cords.

Table 5. Average yields in standard cords per acre at age 16.

Treatment	Yield	Adjusted Yield
Check	31.8	30.9
Weed	37.7	38.6
Tip Moth	32.9	33.8
Weed & Tip Moth	40.1	39.2

Conclusions

Controlling herbaceous vegetation around individual trees for several years following planting significantly increased diameter, basal area, and volume at age 16. One advantage of such treatment might be that thinning could be done at a younger age, or a clearcut for pulpwood would be done a few years earlier. However, these early gains in basal area and volume could also gradually decrease if thinning or harvest is delayed too long. Basal area is rapidly approaching an equilibrium point for the plots receiving herbaceous vegetation control. This will permit the check plots to catch up as competition induced mortality begins on the plots receiving herbaceous vegetation control.

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